LETTERS TO THE EDITOR.

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The Brilliancy and Intensity of the Cupric Chloride Flame Spectrum.

IN the account of an interesting investigation of the flame spectrum of cupric chloride communicated by Peter Kien (*Zeits. f. wissensch. Photographie*, 1908, vol. vi., 337) there occurs a sentence to the following effect:—

"How difficult it is to decide upon the brilliancy and intensity of a spectrum by means of photography may be shown by the following example:—

"Prof. Hartley has published a very beautiful small photograph of the cupric chloride spectrum, the only one, moreover, which up to the present has been published. It is not in the least over-exposed, notwithstanding that Hartley gave it an exposure of two hours. My photographs were over-exposed in ten minutes—even if, as Hartley did, I brought cupric oxide into the oxygen and coal-gas flame saturated with chloroform vapour."

I think it is due to the author and others to point out that he writes under a misapprehension, inasmuch as his spectra and mine were taken each in a different manner and with a different object in view. He desired to photograph the best spectrum obtainable from the chloride for the purpose of measuring the bands, and therefore burnt the usual rolls ("cigarettes") of filter paper containing either cupric chloride or the oxide. The "cigarettes" were pushed by a spring through a tube into the flame at a speed regulated by a clock-work arrangement.

When communicating a paper on some devices facilitating the study of spectra (Sci. Proc. Roy. Dublin Soc., vol. xi., p. 237, 1907), I demonstrated the extreme delicacy of the cupric chloride reaction in explanation of the reason that, although there may be no green coloration of the flame by copper, nevertheless the blue flame and cupric chloride bands are seen when salt is thrown into a fire of glowing coals.

The experiment was made in the following manner:—a quartz fibre about a millimetre thick was placed in a solution of a copper salt and heated in the flame of the Meker (or Mecke) burner supplied with coal-gas, which was burnt with a blast of air at a pressure of about 700 mm. of mercury. The fibre was heated until all the copper salt had been decomposed, as shown by scarcely any evidence of a trace of copper being visible in the flame when looked at in a darkened room. On diverting about one-third of the coal-gas through the flask containing sponge soaked in chloroform, the hydrochloric acid produced by the combustion of its vapour yielded a large and brilliant blue flame due to the cupric chloride, which was steady and continuous for a long period. For the illustration of the text of the paper the first exposure of the copper oxide was limited to two hours, then, without removing the fibre from the flame, the chloroform tap was turned on, and a similar exposure made.

An excess of hydrochloric acid prevents the spectrum being visible at all, so that with the large volume of nitrogen in the air, and the consequent reduction of temperature arising from the hydrochloric acid in the coal-gas flame, the proportion of chloroform vapour must be limited, and the resulting quantity of cupric chloride vaporised is correspondingly small.

In the experiments made by Kien, the greater intensity of photographic action is caused by the use of oxygen under pressure along with coal-gas, whereby, in consequence of the much higher temperature and greater quantity of heat, he is able to feed the flame with a much larger proportion of chloroform vapour, and consequently to volatilise a very much larger quantity of cupric chloride in the same period of time than is possible with the air blast. Furthermore, by the use of the "cigarette," he has a larger quantity of copper in the flame at any given moment.

As a rule, my flame spectra are obtained by using the oxy-hydrogen blow-pipe, and when the hydrogen is mixed with chloroform the photographic period of exposure, according to circumstances, varies from thirty seconds to five minutes.

That salt is decomposed and hydrochloric acid formed by the action of water vapour when salt is thrown into a coal fire is certain. It is proved by the fact, which I found out when studying this spectrum in 1887, that the characteristic blue flame is not obtainable when salt is thrown into a fire of charcoal. In 1890 Salet proved the origin of the blue flame to be cupric chloride (*Comptes rendus*, cx., p. 282), and not in any way connected, as had been suggested, with the spectrum of carbon, carbon monoxide, or hydrocarbon flames, nor due to the element chlorine or to hydrochloric acid. My interest in the matter thus came temporarily to an abrupt termination, because, having by this time become aware that minute quantities of copper are to be found in most metalliferous and many other minerals, also in acids, it was easy to account for the blue flame being frequently seen by reason of the extraordinary delicacy of the cupric chloride flame reaction. Coal ashes always contain copper, the origin of which is commonly pyrites, and in the fire this is speedily burnt to oxide. Sulphur dioxide, steam, and air, even below a very dull red heat, convert salt into sodium sulphate and hydrochloric acid, and hence the formation of cupric chloride in presence of an excess of hydrochloric acid. Kien's paper gives an admirable historical account of the subject, which is particularly interesting owing to the extraordinarily illusive and elusive character of this spectrum. Much of this may be read in the *Phil. Mag.* (4), vol. xxiv., 417–9, and the pages of NATURE during 1876 and 1879.

A very beautiful engraving of the cupric chloride bands is given in Lecoq de Boisbaudran's "Spectres lumineux," published in 1874. W. N. HARTLEY.

Royal College of Science, Dublin, February 11.

On the Radio-active Deposits from Actinium.

IN the course of some experiments which Mr. W. T. Kennedy has been making at Toronto during the past few months, he has found a marked similarity in the active deposits obtained on positively and negatively charged electrodes placed within an air-tight vessel and subjected to the influence of the active emanation issuing from a sample of actinium.

In his experiments the electrodes consisted of two small circular brass discs provided with guard rings of the same metal, and placed parallel to each other at a distance of 2 mm. apart. The discs during an exposure were placed with their planes vertical and directly over an open metal tube 1·5 mm. in diameter, with the edges of the guard rings almost in contact with the edges of the upper end of the tube. The salt used was carried in a small tray which could slide freely up and down the tube, and by means of a clamp be supported at any required distance from the discs.

In carrying out a set of experiments on the effect of varying the pressure of the air in the vessel containing the discs and the salt, it was found at high pressures that the active deposit appeared almost entirely on the negative electrode. As the pressure was decreased, however, the active deposits on both electrodes increased, and ultimately at certain definite pressures, which were different for the two electrodes, reached maximum values. When the pressures were still further lowered, the amounts of the deposit received on both electrodes rapidly decreased, and finally approached equality. Up to the present the lowest pressure used is ½ mm. of mercury, and at this pressure the deposit on the negative electrode was found to be only about 3 per cent. greater than that obtained on the positive. From the rapid character of the decrease in the amounts of the deposit obtained at the lower pressures, it seems highly probable that, with the arrangement of apparatus used, and the relative distances between the parts adopted, both electrodes would fail to show any activity, or at greatest a very small one, if the air were entirely removed from the exposing vessel.

In a particular experiment with the salt at a distance of 1 cm. from the disc electrodes, a maximum activity was

obtained on the negative electrode at a pressure of 6·5 cm. of mercury, while for the same distance between the salt and the electrodes the maximum deposit on the positive electrode was not obtained until a pressure of 1 cm. of mercury was reached. In this experiment the maximum activity obtained on the negative electrode was about 2·75 times the maximum activity obtained on the positive terminal. In all the experiments at the various pressures the discs were exposed for two hours to the action of the emanation from the actinium before being removed from the exposing vessel for measurement. The salt used was obtained from the Chinin Fabrik at Brunswick, Germany, and the active deposits on both the electrodes were found to have a decay period of approximately thirty-nine minutes.

The experiments as a whole point to the ions produced by the radiation from the active salt and its products in the gas in which the salt is placed as the carriers of the active deposit. They seem to indicate, moreover, that the known differences in the rates of diffusion of positive and negative gaseous ions will suffice to explain the differences obtained in the amounts of the active deposit on the two electrodes.

J. C. McLENNAN.

Physical Laboratory, University of Toronto,
February 6.

Germination of the Broad Bean Seed.

MR. HEBER SMITH'S observations on the relation of the micropyle to the radicle in the seed of *Vicia faba* (NATURE, February 4, p. 400) are quite correct. It is surprising that the structure and germination of this seed, so extensively used in elementary botanical teaching, should be so frequently misunderstood by teachers and wrongly described in text-books. The curious minute structure of the coat of leguminous seeds has been thoroughly investigated by Haberlandt, Beck, Pammel, and others, but has never, to my knowledge, found mention in any student's text-book. There is, however, no excuse for the inaccurate statement, made in many an elementary work on botany and on nature-study, that the radicle always grows out through the micropyle when germination begins. Beyond admitting water into the seed, the micropyle, as a rule, merely forms a weak spot in the testa and enables the radicle to split the latter, while in leguminous seeds the splitting occurs quite independently of this aperture.

In the broad-bean seed, with its well-developed "radicle-pocket," the swelling radicle, aided by the elongating cotyledon-stalks, pushes out a V-shaped flap, the micropyle being (as Mr. Heber Smith states) left intact. The two "lines of weakness," which form the edge of the flap, answer to the junction of the radicle-pocket with the inner surface of the testa. The partition which constitutes the inner wall of the pocket can be seen in sections of young seeds as a ridge projecting into the seed cavity between the micropyle and the radicle.

In the seeds of French bean (*Phaseolus vulgaris*) and scarlet runners (*P. multiflorus*, &c.) the pocket is less highly developed, and at an early stage the coat splits transversely, starting from the tip of the radicle. As in the broad bean, the micropyle remains intact at the end of the hilum.

The early stages in the germination of broad bean are, I believe, accurately shown in my "Life-histories of Common Plants," Fig. 10.

FRANK CAVERS.

Hartley University College, Southampton,
February 13.

Scientific Societies and the Admission of Women Fellows.

NATURE of February 11 contains an able article on the Chemical Society and the admission of women fellows. Much of what is said in that article would apply equally well to the Geological Society.

On May 15, 1907, the council proposed a new bye-law for the admission of women as "associates." There is no authority in the charter for the admission of associates, whether women or men; and the proposition was rejected by a majority of two. The council having apparently dropped the subject, a special meeting was, on the requisition of certain fellows, held on April 1, 1908, when a resolution was proposed by Mr. E. A. Martin for the admission of women as fellows. This was defeated in favour of a motion by a member of the council that a poll be taken of all the fellows resident in the United Kingdom. The validity of such a poll having been questioned, the president (Prof. Sollas) admitted that there would be no validity in it, but said that, whatever the result might be, the council would loyally abide by it. The result of this poll was in favour of the admission of women as fellows. Subsequently, some non-resident fellows having objected to being excluded from voting, a further poll was taken of non-resident fellows, with a similar result. The votes recorded in the two polls were:—in favour of the admission of women, 439; against, 160. Of the 439, 318 were in favour of admitting women as fellows, 109 as "associates," while 12 expressed no preference. It is thus shown that there is a decided preference for the admission of women as fellows.

Notwithstanding these votes, and the statement that the council would abide by the result, the council has apparently done nothing to carry them into effect; but on February 10 a special meeting (convened by the council) was held to consider the result of the vote, but no intimation was given that any resolution would be proposed. The council put forward certain objections to the admission of women, and a motion by Dr. A. Smith Woodward, "That it is desirable, under the existing charter, to admit women to candidature for the fellowship of the society, on the same terms as men," was rejected by a majority of ten votes.

Whatever objections the council may have to the admission of women as fellows, it seems only reasonable that the fellows should have been informed before being called upon to express their wishes. By inviting them to vote, it was certainly implied that the decision of the fellows would be respected.

During the past twenty years there have been many able papers contributed by lady geologists, and the fellows have expressed a wish that women should now be admitted to the society on the same terms as men. By rejecting the wishes of the fellows, the council is acting, not only unjustly to lady geologists, but is ignoring the expression of opinion which the council itself invited.

Hythe, February 20.

W. J. ATKINSON.

Stone Circles in Ireland.

IN his paper, "Who built the British Stone Circles?" read at the Dublin meeting of the British Association (NATURE, December 24, 1908, vol. lxxix., p. 236), Mr. J. Gray says he believes there are few, if any, such stone circles in Ireland. The accompanying photograph shows

Stone Circle, Culdaff, Co. Donegal.

one at Culdaff (river, bay, and village of the same name), on the north coast of County Donegal.

Only a few of the stones are now standing. Some have fallen down, others have been taken for building or other purposes; enough, however, still remain to show the form of the circle. Beyond it, on the eastern side, lie several blocks in two diverging rows. A short distance away there is a double-chambered structure of upright slabs, once covered by a mound, which, many years ago, was carted away and spread over the farm by a former tenant.

W. E. HART.

Kilderry, Londonderry, February 15.